

A REVIEW OF THE CEPHALOPOD GENERA SEPIOLOIDEA, SEPIADARIUM, AND IDIOSEPIUS.

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Charts 10, 11, and Text Figs. 64-67.

THE receipt, a short time since, of some interesting material of the cephalopod genera, *Sepioloidea*, *Sepiadarium*, and *Idiosepius*, from the Board of Governors of the Public Library, Museum, and Art Gallery of South Australia, has caused me to review the literature of these aberrant sepioliform squids as critically as possible. One of the genera, *Idiosepius*, is new to the Australian fauna, where it is represented by a hitherto unnoticed species. A South Australian *Sepiadarium* also appears to be new. Pending the appearance of the more complete report in which they, with other species, are to have detailed treatment, short preliminary diagnoses of both species are here offered, together with a brief review of the previously described forms of similar affinities, which it is hoped will prove convenient to other students, even though this portion of the paper perforce contains little that is truly original. Tentative keys to the species are likewise added.

Note.—The figures following authors' names refer to the bibliography, those within brackets to the pagination of reprints.

FAMILY SEPIOLIDAE.

SUB-FAMILY SEPIADARIINAE.

Sepio-Loliginei, sub-fam. **Sepiadarii** Steenstrup, 1881, p. 233, 239 (23, 29).

Sepiadariidae Fischer, 1882, p. 350.

Sepioladae, sub-fam. **Sepiadarii** Appellöf, 1898, p. 623.

Sepiolidae, sub-fam. **Sepiadarinae** Naef, 1912, p. 246, 248.

The earliest discovered member of this group was the "*Sepiola lincolata*" Quoy and Gaimard (1832). The very peculiar features by which this unique creature differs from the true *Sepiola* were recognized a few years later, and it was made by d'Orbigny (1839), the type of his genus *Sepioloidea*.

For many years nothing of special consequence was added to our knowledge of the group, until in 1881 the genus *Sepiadarium* Steenstrup was founded for the accommodation of another peculiar small sepioliform squid, specimens of

which were in Professor Steenstrup's hands from the Indian Ocean, China, and Japan, and which thereupon received from him the name *Sepiadarium kochii*. Steenstrup recognized the evident relationship of his new genus with the earlier *Sepioloidea*, and since he was a devoted believer in the all-sufficiency of the hectocotylized arm in matters of classification, he placed both genera, along with *Sepia*, *Idiosepius*, and *Spirula*, et al., in his family *Sepio-Loliginei*, comprising all myopsids having the ventral arms the ones affected by hectocotylization. Their obvious differences from the other members of this group he recognized by placing them in a special sub-family, *Sepiadarii*, which he allocated between the true *Sepias* (*Eusepii*) on the one hand, and the *Idiosepii* on the other.

The same year Verrill (1881, p. 417), in noting the publication of Steenstrup's monograph, suggested the affinity of the new genus with *Loligo*, rather than with *Sepia*.

Fischer (1882, p. 350) was evidently impressed with the difficulties attendant upon either suggested treatment, for he removed both *Sepioloidea* and *Sepiadarium* to a new family, the *Sepiariidae*. He wrote: "Les Céphalopodes de cette famille ont plus d'affinité avec les *Sepiidae*, les *Spirulidae* et les *Loliginidae* qu'avec les *Sepiolidae*, dont ils présentent toutefois la forme générale." Fischer, therefore, although adopting an essentially modern arrangement, differs from Steenstrup merely in his expression of the facts, not his understanding of their meaning.

With the next student, Brock (1884), it is quite otherwise. Vigorously assailing the position of Steenstrup, he flatly denied the *Allmacht* of the hectocotylus, and writes (p. 108): "Wir müssen uns entscheiden ob für die Bestimmung der Verwandtschaft die Hectocotylization oder alle übrige vergleichend-anatomische Merkmale massgebend sein sollen"; and, again (p. 110): "Es erhellt aus diesen Beispielen also genugsam, dass die Hectocotylization weder in Bezug auf die Zahl und Reihenfolge der umgebildeten Arme, noch in Bezug auf den Modus der Umbildung selbst sich irgendwie mit den übrigen verwandtschaftlichen Beziehungen deckt, und ich stehe daher nicht an, im Gegensatz zu Steenstrup zu behaupten, dass die Hectocotylization trotz ihres hohen morphologischen und physiologischen Interesses für die Erkenntniss der natürlichen Verwandtschaft von keiner oder ganz untergeordneter Bedeutung ist." He therefore referred not only *Sepiadarium* and *Sepioloidea*, but *Idiosepius* as well, outright to the *Sepiolidae*.

The unconvinced Steenstrup, however, maintained his position in a spirited reply (1887) to Brock.

The next contribution of consequence is that of Appellöf (1898). Working on material from the island of Ternate in the Moluccas, he showed many reasons

for relating *Scpioloidea* and *Scpiadarium* to the sepiolids rather than to the sepioids, and hence placed them in a sub-family, *Scpiadarii*, of his family *Scpiolidae*. Unfortunately most of his group names are not formed according to modern etymological rules, so cannot now be used.

Naef (1912, p. 248) places both genera in a sub-family *Scpiadarinae* of the *Scpiolidae*, which arrangement therefore stands as the most recent treatment of the group.

It is easy to pick flaws in the argument of almost any of these writers. In fact each view advanced seems to find its strongest support in attacking the weak points of opposing views, only Steenstrup and Appellöf succeeding in adding many new facts to the discussion. In fairness it must be said that the more recent taxonomic work on other groups of cephalopods has tended to bear out in the main the faith of Steenstrup in the tactical value of the hectocotylized arm as a criterion of systematic relationship. On the other hand it is always easy to overstress any single feature, especially where, as in this instance, our embryological and anatomical knowledge is still scanty. Certainly no present-day student would place either of these genera under the *Scpiidae*, or under the *Loliinidae*, groups which are now known to lie rather far apart phylogenetically instead of closely linked as Steenstrup understood them. Very conceivably some such splitting of the old families as that proposed by Fischer must ultimately be adopted, but in the lack of so much of the essential evidence, the ends of the present paper will no doubt be served best by following the weight of opinion, which brings us into essential agreement with the principles, if not the names, of Appellöf.

The number of species in the sub-family is few. *Scpioloidea* contains but the single species upon which it was founded. Since the description of *S. kochii*, the type species of *Scpiadarium*, the only species added to the genus has been Robson's *auritum* in 1914. The third species here brought to light is not so very different from the other two. The distribution of *Scpioloidea* is wholly Australian as far as we know from the published records. *Scpiadarium* is a more characteristic member of the Indo-Malayan fauna, reaching from Ceylon and southern Japan to South Australia.

KEY TO GENERA OF THE SUB-FAMILY SEPIADARIINAE.

- a. Mantle not fused with funnel, but articulating therewith by a cartilaginous socket and nodule; body strongly papillose on the sides and with conspicuous longitudinal colour bands dorsally; mantle margin strongly lacinate near nuchal commissure. *Scpioloidea*, p. 350

- aa. Mantle firmly fused with base of funnel on each side;
 no evident papillation or conspicuous colour pattern;
 mantle margin entire (?) or weakly digitate near the
 nuchal commissure *Scpiadarium*, p. 351

SEPIOLOIDEA d'Orbigny, 1839.

- Scpioloidea* d'Orbigny, 1839, p. 240; 1845, p. 242.
 .. Steenstrup, 1881, p. 224, 232, 233, 238, 239 (14, 22, 23, 28, 29).
 .. Fischer, 1882, p. 350.
 .. Brock, 1884, p. 105-114.
 .. Steenstrup, 1887, p. 67-75, 116 (21-29, 70).

SEPIOLOIDEA LINEOLATA Quoy & Gaimard, 1832.

1832. *Scpiola lineolata* Quoy & Gaimard, Voy. Astrolabe, ii, p. 82, Moll., pl. v,
 fig. 8-13.
 1839. Gervais & Van Beneden, Bull. Acad. Belg., v, p. 426.
 1839. *Scpioloidea lineata* d'Orbigny, in d'Orbigny and Ferussac, Céph. acét., p.
 240; Sépioles; pl. iii, fig. 10-18.
 1845. d'Orbigny, Moll., iv, foss., p. 242, pl. ix.
 1849. *Scpiola lineata* Gray, Ceph. Brit. Mus., p. 95.
 1875. *Scpioloidea lineolata* Steenstrup, Vid. Selsk. Skr., (5), nat. math., x, p. 472
 (10) (brief note).
 1879. *Scpiola lineolata* Tryon, Man. Conch., (1), i, p. 157, pl. lxvi, fig. 242; pl.
 lxvii, fig. 240, 241, 243.
 1881. *Scpioloidea lineolata* Steenstrup, K. d. Vid. Selsk. Skr., (6), i, p. 214, 224
 (4, 14).
 1882. Fischer, Man. Conch., p. 350.
 1884. Brock, Zeitschr. wiss. Zool., xl, p. 105, fig. (hectoc-
 tylus).
 1892. Brazier, Cat. Ceph. Austral., p. 9.
 1909. Meyer, Ceph. S.W. Austral., p. 329, 330, fig. 3.

Chart No. 10.

Type Locality. Jervis Bay, New South Wales (Quoy & Gaimard).

Recorded Distribution. New South Wales: Port Stephens (Brazier); Port
 Jackson and Sydney (Brazier, Brock); Jervis Bay (Quoy & Gaimard). South
 Australia: St. Vincent Gulf (Meyer); Spencer and St. Vincent Gulfs (South
 Australian Museum). Western Australia (Meyer).

Remarks. This beautiful, extremely interesting, and yet little known species would appear to be a not uncommon inhabitant of the waters of the southern portion of the Australian continent. Careful ecological and anatomical work is badly needed, and the latter would do much to clear up its decidedly uncertain relationships. Whether the species is photogenic would likewise be an interesting point to establish.

The description by d'Orbigny eighty years ago still remains the most complete account of the species that we have.

SEPIADARIUM Steenstrup, 1881.

- Sepiadarium* Steenstrup, 1881, p. 214 (4).
 .. Verrill, 1881, p. 417 (suggests relationship to *Loligo*).
 .. Fischer, 1882, p. 350.
 .. Brock, 1884, p. 105-114.
 .. Steenstrup, 1887, p. 67-72, 116, 120, 121 (21-26, 70, 74, 75).
 .. Appellöf, 1898, p. 570, with figs.

KEY TO THE SPECIES OF SEPIADARIUM.

- a. Fins narrow, nearly four-fifths as long as the mantle .. *auritum*, p. 354
 aa. Fins less than half as long as the mantle 1
 1. Dorsal arms longest; tentacle clubs with extremely minute suckers in 8 or more rows (if we may judge by Steenstrup's figure); hectocotylized arm of male armed with a series of grooved, transverse, pad-like lamellae on distal portion, bounded by a fold-like membrane *kochii*, p. 351
 1'. Lateral arms longest; tentacle clubs with about 6 rows of small suckers on widest portion and a wide keel; hectocotylized arm of male armed with a series of conical lamellae on distal portion, not bounded by distinct folds or continuous membranes. *austriinum*, p. 354

SEPIADARIUM KOCHII Steenstrup, 1881.

1881. *Sepiadarium kochii* Steenstrup, K.D. Vid. Selsk. Skr. (6), i, p. 218, 235 (8, 25), pl. i, fig. 1-10.
 1887. .. *kochii* Brock, Zool. Jahrb., Syst., ii, p. 595 (recorded from Amboina).

1896. *Sepiadarium kochii* Goodrich, Trans. Linn. Soc., (2), Zool., vii, p. 3
(recorded from off Ceylon and Andaman Islands).
1898. " *kochii* Appellöf, Ceph. Ternate, p. 593, pl. xxxii, fig. 9-10;
pl. xxxiii, fig. 19, 21; pl. xxxiv, fig. 23, 25, 27.
1904. " *kochii* Hoyle, Ceph. Ceylon, p. 187, 198 (recorded from off
Pt. de Galle, Ceylon).
1913. " *kochii* Sasaki, Zool. Mag. Tokyo, p. 247, 398, fig. 2 (in
Japanese).
1914. " *kochii* Sasaki, Annot. Zool. Japon., viii, p. 597.

Chart No. 10.

Type Locality. Deep Water Bay, Hong Kong (Steenstrup).

Recorded Distribution. Japan: Enoura, Suruga (Sasaki); off Nukumi, Satsuma (Sasaki); Beppu, Bungo (Sasaki); Kurihama, Musashi (Sasaki); Nagasaki, Hizen (Sasaki). China: Hong Kong (Steenstrup). India: 32 fathoms, 6° 6' 30" Lat. N., 81° 23' Long. E., off south coast of Ceylon (Goodrich); 16-30 fathoms, south of Point de Galle, Ceylon (Hoyle); Andaman Islands (Goodrich). East Indies: Near Banda Islands (Steenstrup); Ternate (Appellöf); Amboina (Brock).

Remarks. The special features of *S. kochii*, as figured by Steenstrup, are the very numerous and minute suckers of the narrowly keeled tentacle club, the arm formula 1, 3, 4, 2 (possibly somewhat variable), the small fins, and the details of the hectocotylized arm. In the type (a male) the latter apparently had 9 pairs of suckers, succeeded by a series of about 26 thick, longitudinally grooved, transverse pads, bordered by a marginal fold or membrane best developed ventrally.

Sasaki (1914, p. 598) notes a number of discrepancies from Steenstrup's original description in the Japanese specimens examined by him. Some of them are not of great consequence, but others are of such a nature as to suggest the possibility that more than one recognizably distinct form has been included under *kochii* in the literature.

From Steenstrup's description I cannot make out just which of his specimens he regarded as the type, but since most of his figures are of a male from Deep Water Bay, Hong Kong, the presumption is strong if not conclusive that this is properly regarded as the type locality. If this be granted, the following specimens in the collection of the Museum of Comparative Zoology are clearly referable to the true *kochii*.

Material examined:

Specimens Examined.	Sex	Locality	Collector.	Date.	Where Deposited.	Number in Author's Register.
2	♀	Hong Kong, China.	Capt. W. H. A. Putnam.	Mar. 1861.	M. C. Z. 3446	268
3	1 ♂ 2 ♀	.. ..	.. ..	..	M. C. Z. 1537	269
9	3 ♂ 6 ♀	.. ..	.. ..	..	M. C. Z. 1571	270

In this series the males run considerably smaller than the females. The bodies of the females are more rounded than those of the males, and the fins are relatively larger, although these differences may depend in part at least on the varying manner of preservation. As the specimens have not been seen by me for some years, I am unable to add any further notes regarding them at this time.

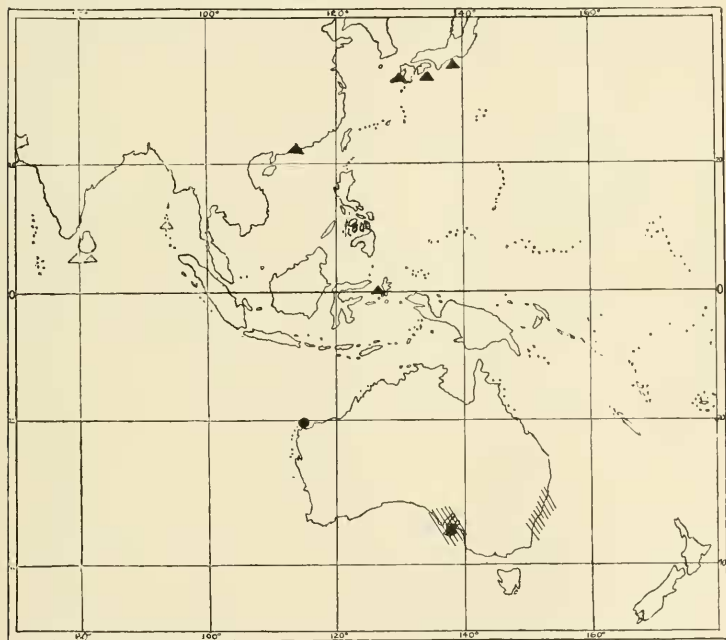


Chart 10. Indo-Pacific Faunal Region, showing distribution of the genera *Sepioloidea* and *Sepiadarium*.

▨ *Sepioloidea lineolata*.

● *Sepiadarium auritum*.

▲ *Sepiadarium kochii*

■ *Sepiadarium austrinum*.

SEPIADARIUM AURITUM Robson, 1914.

1914. *Sepiadarium auritum* Robson, Proc. Zool. Soc., 1914, p. 677, text fig. A-E.

Chart No. 10.

Type Locality. Off Hermite Island, Monte Bello Group, Western Australia (Robson).

Recorded Distribution. Known only from the type locality.

Remarks. This species has been but briefly characterized, but the figures lead one to believe that it will prove to be distinct from either of the other forms here recognized. The long, narrow fins are especially characteristic. Robson (1914, p. 677) appears to consider his species after a manner an intermediate form between *Sepiadarium* and *Sepioloidea*, but the fin characters mentioned are hardly sufficient for one to recognize it as other than a thorough-going *Sepiadarium*.

SEPIADARIUM AUSTRINUM sp. nov.

Chart No. 10.

Diagnosis. Body small, sepioliform. Fins semicircular or semicordate, less than half the length of the body, attached well behind the middle. Head large, about as wide as the body. Arms nearly as long as body, the two dorsal pairs a little longer than the ventral two. Suckers small, biserial, but sometimes crowded into 4 rows near middle of arm, and almost always in 4 rows at tips where they become much reduced in size. Hectocotylized arm of male with 9½-10 pairs of normal suckers on basal portion, these replaced distally by a single series of stiff, somewhat pointed, tongue-shaped lamellae, more or less grooved at the apex in such a way as finally, at the very tip of the arm, to result in the lamellae being split into alternating rows of small papillae; true marginal webs absent; entire arm strongly recurved dorsally and the resulting concavity excavated. Tentacle clubs strongly keeled and with about 6 rows of small suckers on the widest part, largest ventrally. Total length of type specimen, 32.0 mm. Dorsal length of mantle, 12.3 mm. Width of body, 12.5 mm.

Type Locality. St. Vincent Gulf, South Australia (A. Zietz, September, 1885).

Recorded Distribution. Known only from the type locality.

Remarks. The most distinctive feature of this little squid, as compared with its two congeners, lies in the structure of the hectocotylus. In general plan the hectocotylus is similar in all three species of *Sepiadarium*, but in

austrinum the lamellae are conical rather than transversely ridge-shaped, they are not longitudinally folded or crenulate, there are fewer of them, and the marginal membranes so conspicuously developed in the other forms are here almost or quite lacking. The fins of both sexes are more like those of *kochii* than those of *auritum*. Close checking with the original descriptions and figures of both these forms will reveal numerous other differences of detail.

An interesting feature of the present species, which I have not dwelt upon in the diagnosis, is the incipient digitation of the mantle margin near its junction with the nuchal commissure, evidently a rudiment or vestige of the curious arrangement which is pushed to such an extreme in *Sepioloidca*. I am not aware that this has been observed in any other species of *Sepiadarium*, but the present material indicates that it is a condition easily obscured by inadequate preservation, so too much stress should not be laid upon its apparent absence in the others.

A full description of this species, with figures, will appear in a forthcoming monograph on the South Australian cephalopods.

FAMILY IDIOSEPIIDAE.

Sepio-Loliginei, sub-fam. **Idiosepii** Steenstrup, 1881, p. 233, 240 (23, 30).

Idiosepiidae Fischer, 1882, p. 350.

.. Appellöf, 1898, p. 623.

.. Naef, 1912, p. 243.

IDIOSEPIUS Steenstrup, 1881.

Idiosepius Steenstrup, 1881, p. 219, 233, 236, 240 (9, 23, 26, 30).

.. Verrill, 1881, p. 417 (suggests relationship to *Loligo*).

Idiosepion Fischer, 1882, p. 350.

Idiosepius Brock, 1884, p. 105-114.

.. Steenstrup, 1887, p. 67-72, 116, 119, 120, 121 (21-26, 70, 73, 74, 75).

Microteuthis Ortmann, 1888, p. 648.

Idiosepius Appellöf, 1898, p. 570, with figs.

Idiosepius, the only genus now recognized as belonging to the aberrant family *Idiosepiidae*, was originally described by Steenstrup along with *Sepiadarium* about 40 years ago (1881, p. 219), and like the latter genus was founded on a single species, *I. pygmaeus*, based on specimens from the East Indies and Zamboanga in the Philippines. Steenstrup clearly noted the unique features which mark the genus and which separate it from even the *Sepiadarioid* group, and so placed it in a new sub-family, *Idiosepii*, of his family *Sepio-Loliginei*.

The subsequent history of the group is much the same as that of *Sepiadarium*, and is the result of the efforts of much the same group of investigators. As in

the case of *Sepiadarium*, Verrill (1881) suggested an affinity with *Loligo* rather than with *Sepia*. The following year Fischer (1882) established the group in full family standing under the name *Idiosepiidae*, placing it between the *Sepiadaridae* and the *Loliginidae*. The generic name he amended to *Idiosepius*, but not in a manner which is now held to be permissible.

Brock (1884, p. 105) referred this genus to the *Sepiolidae* along with *Sepiadarium* and *Sepioloidea*, but Steenstrup (1887) again showed cause for the rejection of this view.

Ortmann (1888, p. 648), in working on Japanese material, recognized the apparent similarity of his specimens to *Idiosepius*, but because he considered them referable to the *Sepiolidae*, described them as a new genus and species, *Microteuthis paradoxa*. There seems little doubt that subsequent authors have been correct in suppressing *Microteuthis* as a complete synonym of *Idiosepius*, but for reasons to be given on a subsequent page, it is probable that the species is perfectly valid, and will stand as the second of the genus.

Appellöf (1898) made important contributions to our knowledge of the group, working on extensive material from Ternate, where these little squids apparently occur in abundance. He came to the well-supported conclusion that Fischer's recognition of the family as distinct from the *Sepiolidae*, *Sepiidae*, or *Loliginidae* is justifiable, and practically all writers have since followed this view, especially since no further evidence germane to the question has been brought to light.

A third species was added to the genus by Joubin (1894), although he did not at once recognize its affinity with *Idiosepius* and described it as *Loligo picteti*. This form came from Amboina.

In summing up it may be said that the *Idiosepiidae* comprise a monogeneric group of three slightly differentiated species, strictly characteristic of the Indo-Pacific faunal region, which they are now known to inhabit from the region of Borneo and the Banda Sea on the south to southern Japan on the north. To these a fourth species is here added which carries the distribution of the group to the south of the Australian continent (see map, text fig. 2). Unfortunately, of the habits and ecology of any of the species, nothing whatever is known.

KEY TO THE SPECIES OF IDIOSEPIUS.

- a. Tentacles variable, with small clubs, one-third the length of the tentacle or less; ventral arms of male with only a single sucker at base of each 1

- aa. Tentacles as thick or thicker than the arms, bearing suckers for more than half their length; ventral arms of male with several or many normal suckers 2
1. Body minute (total length 12-15 mm.), sepioliform, more or less rounded behind; ventral arms of male distal to basal sucker smooth, suckerless, the right arm much thicker and heavier than its mate; tentacles very conspicuously more slender than the arms *pygmaeus*, p. 357
- 1'. Body larger (mantle length 17 mm.), elongate, tapering posteriorly; right ventral arm of male very short and broad, heavily transversely plicate on the oral face distal to the basal sucker, the aboral surface with a deep longitudinal groove; left ventral arm of male more slender and longer than its mate, the portion distal to the very minute basal sucker smooth, and the tip made bilobate by the projection of a small, tongue-like process on the oral face *picteti*, p. 359
2. Body small (mantle length 10 mm.); right ventral arm in male with 3-5 suckers at base, otherwise bare; left ventral arm in male with 4-7 suckers at base, otherwise bare except for a semi-circular membrane on the dorsal side near tip *paradoxus*, p. 358
- 2'. Body larger (mantle length of male 15.8, of female 21.6 mm.); strongly sexually dimorphic; both ventral arms in male normally suckered for most of length, the right a trifle shorter than its mate, its extremity only bare; left similar but the tip furnished with two conspicuous fleshy flaps *notoides*, p. 361

IDIOSEPIUS PYGMAEUS Steenstrup, 1881.

1881. *Idiosepius pygmaeus* Steenstrup, K.D. Vid. Selsk. Skr. (6), i, p. 219, 236 (9, 26), pl. i, fig. 11-22.
1882. *Idiosepiion pygmacum* Fischer, Man. Conchyl., p. 351, text fig. 128 (after Steenstrup).

1886. *Idiosepius pygmaeus* Hoyle, Chall. Rep., p. 20, 213, 218.
 1895. " " Joubin, Rev. suisse Zool., iii, p. 460.
 1898. " " Appellöf, Ceph. Ternate, p. 562, 572-593, text fig. 1
 pl. xxxii, fig. 1-5, 7; pl. xxxiii, fig. 11-13, 22;
 pl. xxxiv, fig. 24, 26, 29-30.
 Chart No. 11 and fig. 64.

Type Locality. 4 20' Lat. N., 107 20' Long. E. (Steenstrup).

Recorded Distribution. 4 20' Lat. N., 107 20' Long. E., China Sea, off Gulf of Siam (Steenstrup); Zamboanga (Steenstrup); Banda Sea (Appellöf); Ternate (Appellöf).

Remarks. This small species, even more diminutive (with its gross measurements of but 12 to 15 mm.) than *I. paradoxus*, is to be distinguished, if we are to believe Steenstrup's figures, by the slender tentacles, short tentacle clubs, single suckers persistent on the ventral arms in the male, and the lack of flanges or appendages of any kind on the smooth terminal portions of these arms (text



Fig. 64. Schematic view of ventral arms of male, oral aspect (after Steenstrup).

fig. 3). Several of Steenstrup's figures, however, are not in as complete agreement with one another as they might be, while Appellöf brings into his account several new divergencies. Of course it is quite conceivable that the normal variability of individuals of this species is sufficient to account for all this and more, but the relative constancy described for Japanese specimens and likewise noted by me in Australian material of the genus, leads me to suspect otherwise, and that even in Steenstrup's original material there is a possibility that more than one species may be involved.

All the Japanese records of *kochii* are apparently referable to *paradoxus*.

IDIOSEPIUS PARADOXUS Ortmann, 1888.

1888. *Microteuthis paradoxa* Ortmann, Zool. Jahrb., Syst., iii, p. 649, 665, pl. xxii, fig. 4.
 1902. " " Joubin, Revis. Sepioidae, p. 105, text fig. 15 (after Ortmann).
 1910. *Idiosepius pygmaeus* (pars) Wülker, Jap. Ceph., p. 22 (merely listed).
 1912. " *paradoxa* Berry, Proc. Acad. Nat. Sci. Phila., 1912, p. 405 (brief note).
 1913. " *pygmaeus* (pars) Sasaki, Zool. Mag. Tokyo, p. 401 (in Japanese), pl., fig. 3.
 1914. " " (") " Annot. Zool. Jap., viii, p. 599.

Chart No. 11 and fig. 65.

Type Locality. Kadsiyama, Bay of Tokyo, Japan (Ortmann).

Recorded Distribution. Japan: Kadsiyama (Ortmann); Misaki, Sagami (Sasaki); Inland Sea (Sasaki).

Remarks. On the ground only of Ortmann's scanty data I once expressed the opinion that this species might prove conspecific with *I. pygmacus*, but the much more complete information since given by Sasaki convinces me that the Japanese *Idiosepius* is clearly a distinct species. A little larger than *I. pygmacus*, it further differs in the short, thick tentacles, suckered for one-half or more of their length, the development of a semicircular flap near the tip of the left ventral arm in the male, and the persistence of 3 to 7 suckers on the basal portion of each modified arm in the male.

The mantle length of the specimens examined by Ortmann and Sasaki is given as 8-10 mm.



Fig. 65 Schematic view of ventral arms of male, oral aspect (after Sasaki).

IDIOSEPIUS PICTETI Joubin, 1894.

1894. *Loligo picteti* Joubin, Rev. suisse Zool., ii, p. 26, 60-64, pl. iii, iv.

1895. *Idiosepius picteti* Joubin, Rev. suisse Zool., iii, p. 460.

Chart No. 11 and fig. 66.

Type Locality. Amboina (Joubin).

Recorded Distribution. Known only from the type locality.

Remarks. This species comes from the very midst of a region reported to be inhabited by *I. pygmacus*, but it seems to be a very distinct form. Here the right ventral arm in the male is very short and broad, its oral surface thrown into about twelve heavy transverse plications, while its aboral surface bears a deep longitudinal furrow. The left ventral arm is more slender and is longer than its mate. Each arm of this pair bears a single small sucker near the base. Other than the sucker and a flattened, tongue-like process on the inner face near the tip, the left arm is unornamented.



Fig. 66. Schematic view of ventral arms of male, oral aspect (after Joubin).

Other peculiarities are the small tentacle clubs, the curious fimbriated edging which surrounds the narrowly delimited sucker-bearing area on the clubs, and

the extremely sudden reduction in size undergone by the suckers of the sessile arms near their extremities.

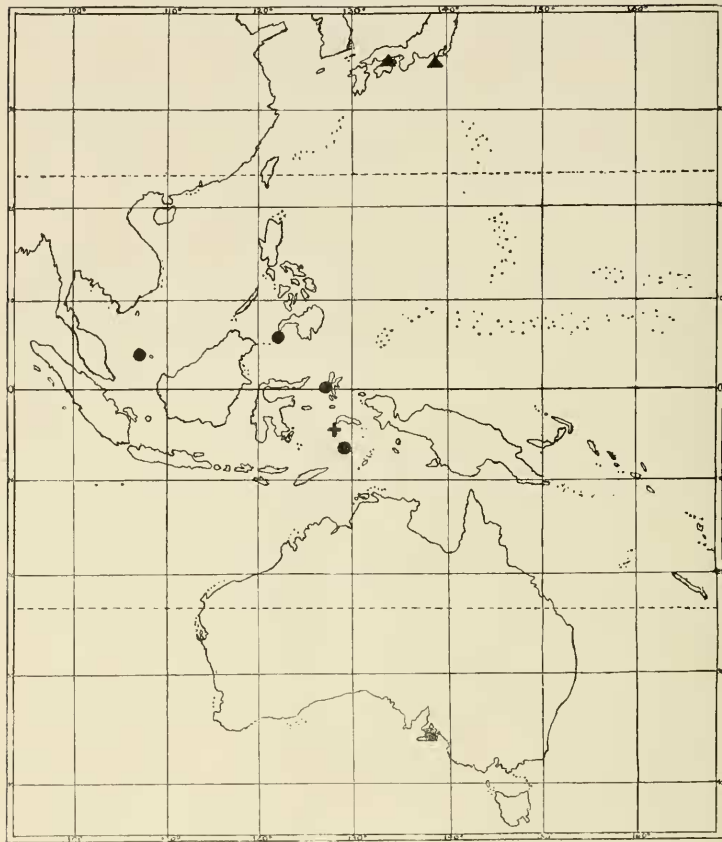


Chart 11. Portion of Indo-Pacific Faunal Region, showing distribution of the genus *Idiosepius*.

● *Idiosepius pygmaeus*.

△ *Idiosepius paradoxa*.

+ *Idiosepius picteti*.

■ *Idiosepius notoides*.

In size *I. picteti* is nearly similar to *I. notoides*. I have seen no specimens of it, but the characters of the hectocotylus as described are such as to lead me to believe the species unquestionably to be valid.

IDIOSEPIUS NOTOIDES sp. nov.

Chart No. 11 and fig. 67.

Diagnosis. Body small in both sexes, but the male especially so; cylindrical, obtusely pointed behind and with a distinct ventral flexion. *Fins* small, semi-circular, about one-third as long as the body, narrowly attached, strongly posterior but not terminal in position. *Head* moderately large, nearly as wide as body. *Arms* short, not very dissimilar in length, about one-third as long as body, the second pair usually a little longer than any of the others. *Suckers* small, rather crowded, biserial throughout. Both ventral arms in the male *hectocotylized*; normal for most of length and bearing 7-11 sucker pairs of the usual type; right ventral arm with the conical tip simple and free of suckers; left ventral arm appreciably longer than right and with a few more suckers, its tip vertically bifurcating into a pair of much compressed, recurved flaps. *Tentacles* short-stout, one and a half to one and three-quarters as long as the arms. *Clubs* large, including nearly the whole exposed length of the tentacles; keel wanting, but sucker-bearing area bordered by a delicate membrane; suckers in two rows at tip and base of club but crowded into three or four on middle. *Colour* of female after preservation, light brown, conspicuously mottled with patches of slaty chromatophores; the male uniformly slaty with a few minute light spots.



Fig. 67. Schematic view of ventral arms of male, oral aspect.

	Type, male.	Paratype, female.
Total length	26.0 mm.	35.0 mm.
Dorsal length of mantle	15.8 mm.	21.6 mm.
Width of body	7.0 mm.	8.8 mm.

Type Locality. Goolwa, South Australia (A. Zietz).

Recorded Distribution. Known only from the type locality.

Remarks. The characters chiefly relied on for the specific discrimination of this little squid are the suckering of the tentacles nearly to the base, the large number of suckers on the sessile arms (twice as many as are figured for *I. pygmaeus*), the extent to which the ventral arms of the male remain normal, and the curious double flap which terminates the left member of this pair. Only *I. picteti* seems to attain so large a size, although the males of the present species

are not nearly so large as the females. The striking sexual dimorphism exhibited is a remarkable feature, but will possibly prove to be a generic rather than a specific character.

The species will be more fully described and mentioned in the forthcoming report to which allusion has already been made.

CONCLUSION.

From the foregoing notes it appears that instead of being practically monospecific genera as some authors have seemed tempted to consider them, both *Sepiadarium* and *Idiosepius* contain a number of fairly well marked geographical races, which, until the existence of actual intergrades be proven, are best considered as distinct species. Both these genera are now seen to have an extended distribution in Indo-Pacific waters, and it is possible that both will prove fairly rich in species as collections are made over a more extended area of this region.

The scanty evidence available indicates that *Sepioloidea* is both a more compact and a more localized genus, the distribution of which through the whole of the region occupied by the other two genera is not to be expected.

BIBLIOGRAPHY.

Appellöf, A.

1898. Cephalopoden von Ternate. 1. Verzeichnis der von Professor Kükenthal gesammelten Arten. 2. Untersuchungen über *Idiosepius*, *Sepiadarium* und verwandte Formen, ein Beitrag zur Belichtung der Hektocotulization und ihrer systematischen Bedeutung. Ergebnisse einer zoologischen Forschungsreise in den Molukken und Borneo, . . . von Dr. Willy Kükenthal, etc., Zweiter Teil: Wissenschaftliche Reiseergebnisse, II, p. 561-637, text fig. 1-2, pl. xxxii-xxxiv.

Berry, S. S.

1912. A catalogue of Japanese Cephalopoda. Proceedings Academy Natural Sciences Philadelphia, 1912, p. 380-444, text figs. 1-4, pls. v-ix.

Brazier, J.

1892. Catalogue of the marine shells of Australia and Tasmania. Part I. Cephalopoda. Australian Museum Catalogue, No. 15, p. i-vi, 1-17, Sydney.

Brock, J.

1884. Das Männchen der Sepioloiden *lineolata* d'Orb. (*Sepiola lineolata* Quoy & Gaim.). Zeitschrift wissenschaftliche Zoologie, xl, p. 105-120, text fig.

1887. Indische Cephalopoden. Zoologische Jahrbücher, Syst., II, p. 591-614, pl. xvi, fig. 1-4.

Fischer, P.

1882. Manuel de Conchyliologie et de paléontologie conchyliologique ou histoire naturelle des mollusques vivants et fossiles, p. i-xxiv, 1-1369, 1138 figs. in text, 23 pls.

Gervais, P., & Van Beneden, P. J.

1838. Sur les malacosoaires du genre Sépiole (*Sepiola*). Bulletin Academie Belgique, v, p. 421-430.

Goodrich, E. S.

1896. Report on a collection of Cephalopoda from the Calcutta Museum. Transactions Linnean Society London, (2), Zoology, vii, p. 1-24, pl. i-v.

Gray, J. E.

1849. Catalogue of the Mollusca in the collection of the British Museum. Part I. Cephalopoda Antepedia, p. i-viii, 1-164.

Hoyle, W. E.

1886. Report on the Cephalopoda collected by H.M.S. Challenger during the years 1873-76. Voyage of the Challenger, xvi, pt. 44, p. i-vi, 1-246, text fig. 1-10, map, pl. i-xxxiii.

1904. Report on the Cephalopoda collected by Professor Herdman, at Ceylon, in 1902. Report Government of Ceylon Pearl Oyster Fisheries Gulf of Manaar, Supplementary Report 14, p. 185-200, pl. i-iii.

Joubin, L.

1894. Céphalodes d'Amboine. Revue Suisse de Zoologie et Annales du Musée d'Histoire Naturelle de Genève, ii, p. 23-64, pl. i-iv.

1895. Note complémentaire sur une céphalopode d'Amboine, *Loligo picteti* *Idiosepius picteti*. Revue Suisse de Zoologie et Annales du Musée d'Histoire Naturelle de Genève, iii, p. 459-460.

1902. Revision des Sepiolidae. Mémoires Société Zoologique France, xv, p. 80-145, text fig. 1-38.

Meyer, W. T.

1909. Cephalopoda. Fauna Südwest-Australiens, ii, p. 329-335, text fig. 1-11.

Naef, A.

1912. Teuthologische Notizen. 1. Die Familien der Myopsiden. 2. Die Gattungen der Sepioliden. Zoologischer Anzeiger, xxxix, p. 241-248.

D'Orbigny, A., & Férussac, A. de

1839. Histoire naturelle générale et particulière des céphalopodes acétabulifères, vivants et fossiles.

D'Orbigny, A.

1845. Mollusques vivants et fossiles ou description de toutes les espèces de coquilles et de mollusques classées suivant leur distribution géologique et géographique, i, p. 1-605, Atlas of 35 pls.

Ortmann, A.

1888. Japanische Cephalopoden. Zoologische Jahrbücher, Syst., iii, p. 639-670, pl. 20-25.

Quoy, J. R. C., & Gaimard, J. P.

1832. Zoologie. In Voyage de l'Astrolabe, pendant les années, 1826-29.

Robson, G. C.

1914. Cephalopoda from the Monte Bello Islands. Proceedings Zoological Society London, 1914, p. 677-680, text fig. A-E.

Sasaki, M.

1913. Decapod cephalopods from Japan (Sepiolidae i). Zoological Magazine, Tokyo, xxv, p. 247-252 (in Japanese).

1913. Decapod cephalopods from Japan (Sepiolidae ii and Conclusion). Zoological Magazine, Tokyo, xxv, p. 397-403 (in Japanese), with plate.

1914. Notes on the Japanese Myopsida. Annotationes Zoologicae Japonenses, viii, p. 587-629, 1 text fig., pl. xi-xii.

Steenstrup, J. J. S.

1875. Hemisepius, en ny Slaegt af Sepia-Blacksprutternes Familie, med Bemaerkninger om Sepia-Formerne i Almindelighed. Videnskabernes Selskabs Skrifter, (5), x, p. 465-482 (1-20), i-iv, pl. i, ii.

1881. Sepiadarium og Idiosepius, to nye Slaegter af Sepiernes Familie. Videnskabernes Selskabs Skrifter (6), i, p. 213-242 (1-32), pl. i.

1887. Notae teuthologicae, (7). Oversigt K. Danske Videnskabernes Selskabs Forhandling, 1887, p. 67-126 (21-80).

Tryon, G. W., Jr.

1879. Cephalopoda. Manual Conchology, (1), i, p. 1-316, pl. i-cxii.

Verrill, A. E.

1881. The cephalopods of the north-eastern coast of America. Part ii. The smaller cephalopods, including the squids and the Octopi, with other allied forms. Transactions Connecticut Academy Sciences, v, p. 259-446, xxvi-lvi.

Wülker, G.

1910. Über Japanische Cephalopoden. Beiträge zur Kenntnis der Systematik und Anatomie der Dibranchiaten. Abhandlungen ii. Klasse K. Bayerischen Akademie Wissenschaften, Suppl. v, iii, p. 1-72, pl. i-v.